Unit-5
Introduction to 3 D Printing

Prerequisite/Recapitulations

- Mathematics
- Drawing, Sketching
- Solid Modelling

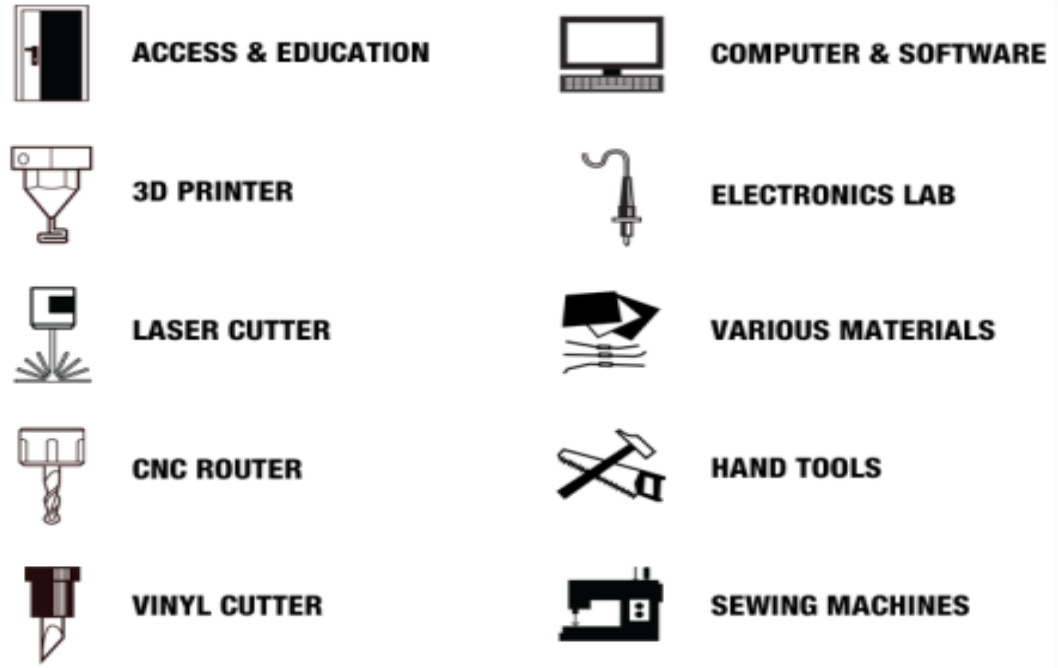
Objectives

To acquire knowledge about:

- ❖Digital Fabrication
- ❖3 D Printing and its importance
- ❖Flow cycle in 3 D Printing
- ❖Slicing
- ❖3 D Printing Technologies
- ❖Fused Deposition Modelling (FDM)

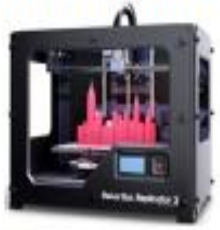
Digital Fabrication

- Machine is controlled digitally (computers)
- Manual skills becomes computer skills
- A digital fabrication lab (fab lab) is a small-scale workshop offering (personal) digital fabrication.
- A fab lab is generally equipped with an array of flexible computer controlled tools that cover several different length scales and various materials, with the aim to make "almost anything".
- This includes technology-enabled products generally perceived as limited to mass production. (Wikipedia)



Some Equipments of Digital Fabrication Lab

3D PRINTER



7-AXIS ROBOT

LASER CUTTERS

CNC KNITTING MACHINE

ZUND KNIFE CUTTER

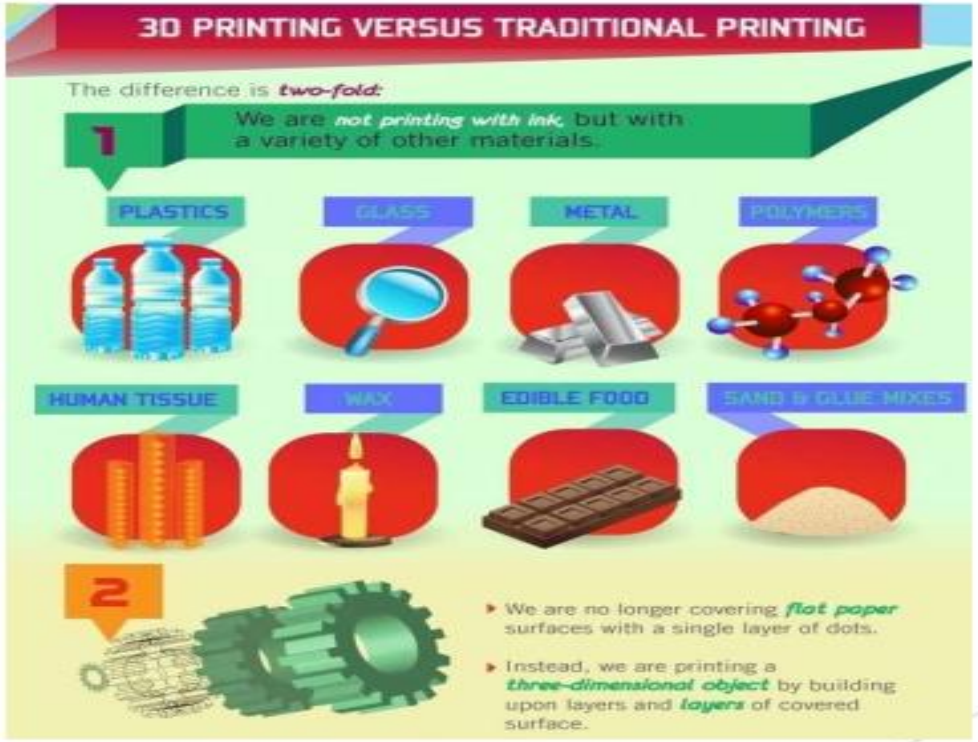
CNC ROUTER

CNC WATERJET

DIGITIZER

3 D Printing

- 3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file.
- The creation of a 3D printed object is achieved using additive processes.
- In an additive process an object is created by laying down successive layers of material until the entire object is created.
- Three Principles: Modelling, Printing and Finishing



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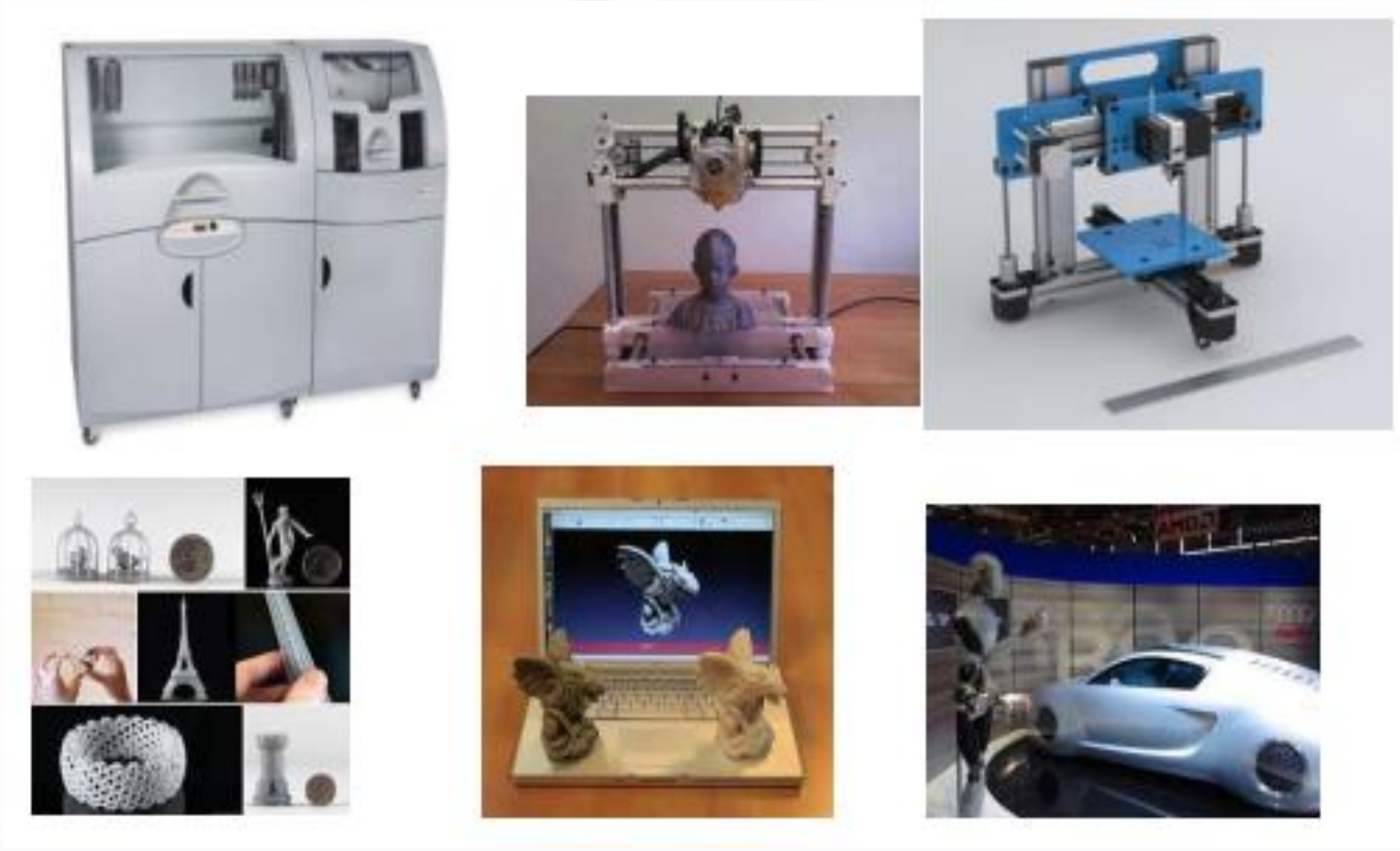
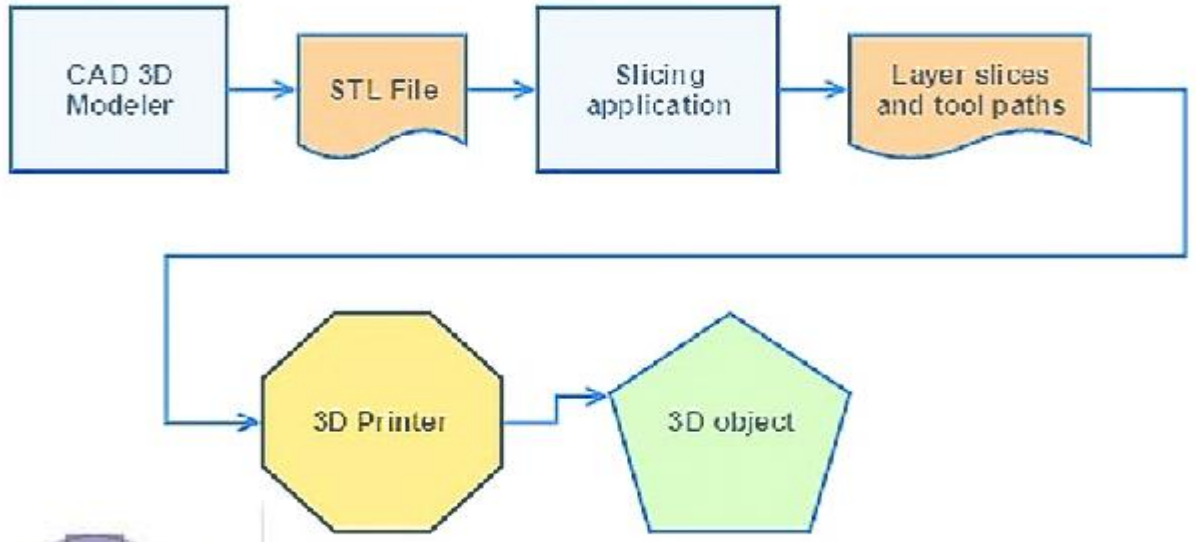
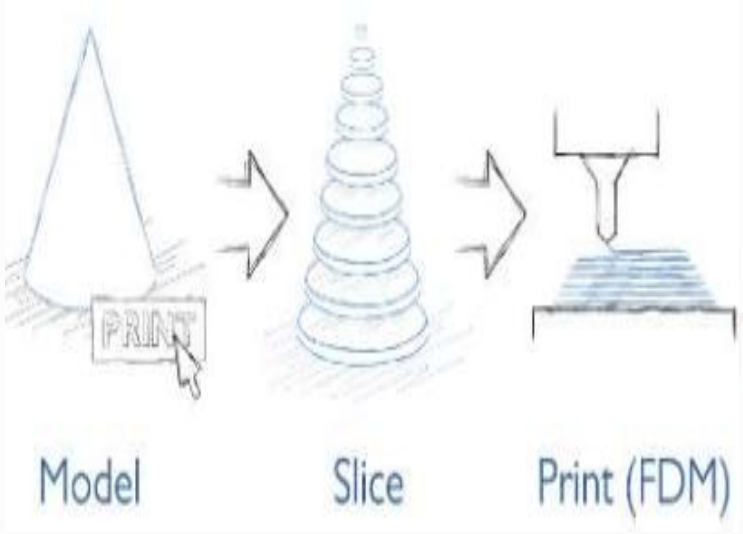
Visualization

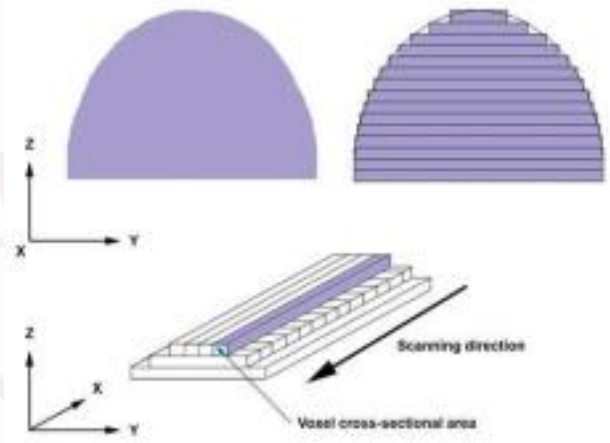


How 3 D Printer Works ?

❖A virtual design of the object is created.
❖CAD (Computer Aided Design) uses a 3D modeling program or 3D scanner for virtual design.
❖The software slices the final model into hundreds or thousands of horizontal layers.
❖The printer creates the object layer by layer, resulting in one three dimensional object.





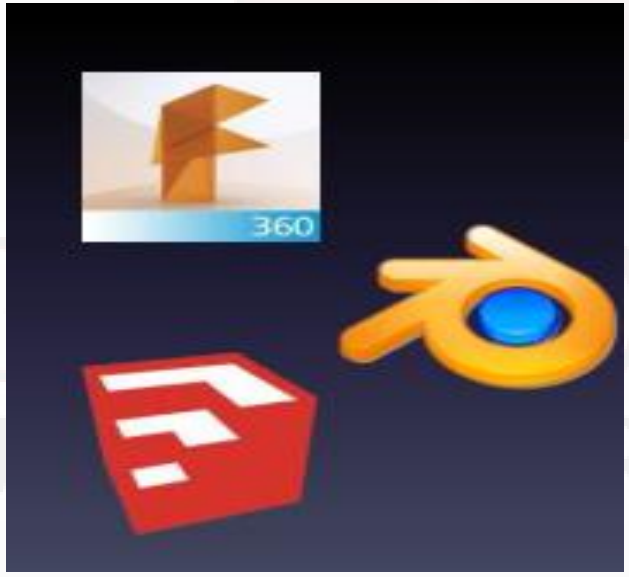


When to use 3D printing?

- Internal geometry
- Multiple parts
- Prototyping

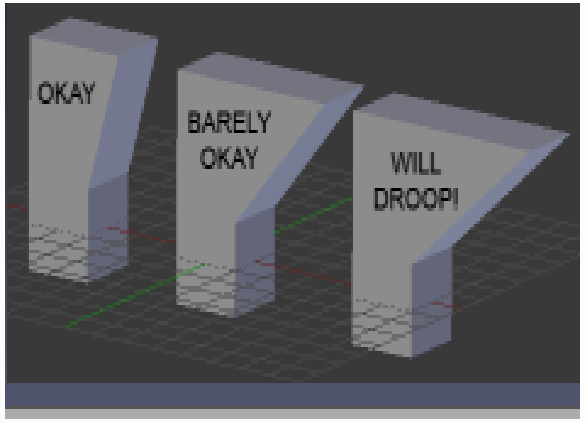
3 D Printer Software Recommendations and Rules

- AutoCAD Fusion 360 (parametric)
- Blender (freeform, free)
- Sketchup (free, plugin to STL)
- Tinkercad
- Solidworks
- CATIA V5



Rules

- Accepts 3D models– STL or OBJ
- Careful with overhangs

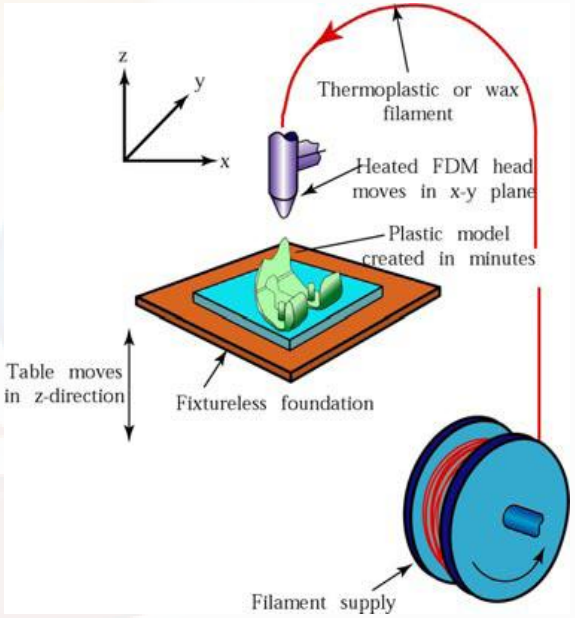


3 D Printing Technologies

1. Liquid-based: Stereolithography, Solid ground curing, Droplet deposition manufacturing
2. Solid-based: Laminated object manufacturing , Fused deposition modeling
3. Powder-based: Selective laser sintering

Fused Deposition Modeling

- A gantry robot controlled extruder head moves in two principle directions over a table
- Table can be raised or lowered as needed
- Thermo plastic or wax filament is extruded through the small orifice of heated die
- Initial layer placed on a foam foundation with a constant rate
- Extruder head follows a predetermined path from the file
- After first layer the table is lowered and subsequent layers are formed



FDM

Advantages:

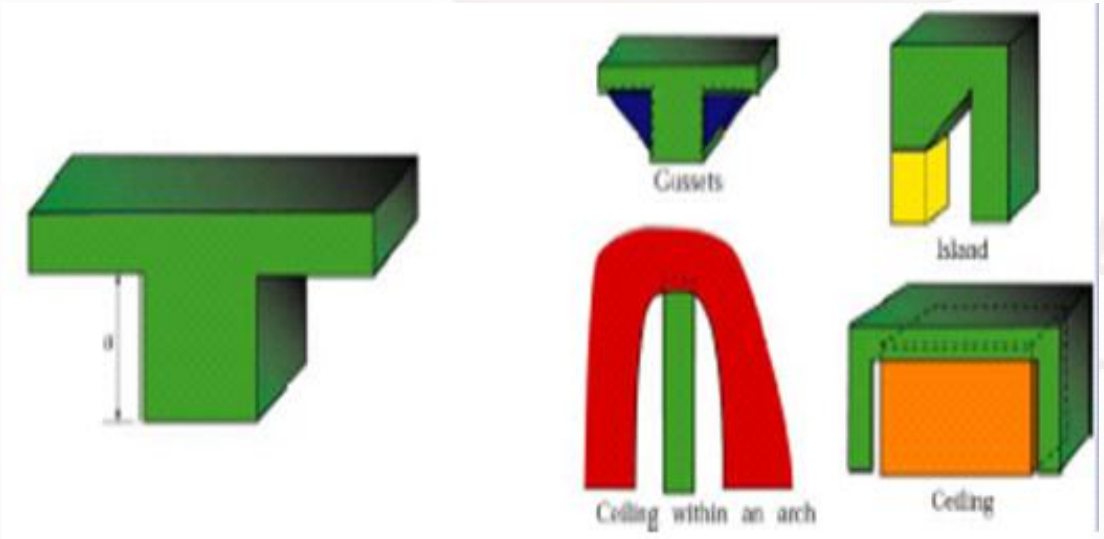
Cheaper since uses plastic, more expensive models use a different (water soluble) material to remove supports completely. Even cheap 3D printers have enough resolution for many applications.

Disadvantages:

Supports leave marks that require removing and sanding. Warping, limited testing allowed due to Thermo plastic material.

Materials:

PLA
ABS
PET
Nylon
TPU



Summary

- 3D Printing uses software that slices the 3D model into layers (0.01mm thick or less in most cases). Each layer is then traced onto the build plate by the printer, once the pattern is completed, the build plate is lowered and the next layer is added on top of the previous one

- 3 D Printing is classified on the basis of raw material used

- 3D printing is inexpensive prosthetics, creating spare parts, rapid prototyping, creating personalized items and manufacturing with minimum waste. The technology is useful and thanks to its widespread availability as well as further development will be even more useful in the future.

Questions

- How do you explain 3 D printing
- Highlight medical applications of 3 D printing
- Identify the parameters in FDM

References

- Chee Kai Chua, Kah Fai Leong(2016), 3D Printing And Additive Manufacturing: Principles And Applications, WSPC

- http://en.wikipedia.org/wiki/3D_printing

- Dan Collins and Don Vance, Arizona State University, Digital Culture / 3D Tools August 23, 2012

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Thank You